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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re the Application of: **HARA, Shoji et al.**

Group Art Unit: **1762**

Serial No.: **09/782,169**

Examiner: **TALBOT, Brian K.**

Filed: **February 14, 2001**

P.T.O. Confirmation No.: 2107

FOR: **LAMINATE COMPRISING POLYIMIDE AND CONDUCTOR LAYER, MULTI-LAYER WIRING BOARD WITH THE USE OF THE SAME AND PROCESS FOR PRODUCING THE SAME**

REQUEST FOR RECONSIDERATION

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

July 11, 2003

Sir:

In response to the Office Action dated February 24, 2003, applicants request favorable reconsideration of the above-identified application. Claims 1-13, 17 and 18 are pending.

Claims 1-13, 17 and 18 were rejected under 35 U.S.C. 103(a) as being unpatentable over Chen or Shiotani et al in combination with Ameen et al. This rejection is respectfully traversed.

The Examiner notes that Chen et al and Shiotani et al each teach applying a metal layer to a polyimide layer and heating to form a conductor layer. The Examiner highlights column 1, lines 27-30 of Shiotani et al which teaches that it is conventional in the art to form the metal layer by plating. Ameen et al teaches vapor deposition or sputtering of a metal layer on a polyimide substrate.

Ameen does not disclose a thermoplastic polyimide. More specifically, Ameen et al does not teach a thermoplastic polyimide since KAPTON is not specifically described. As further support for this argument, the trademark records from the U.S. Patent and Trademark Office with respect to KAPTON are attached hereto. There are two registered trademarks, the first of which describes the

goods as flexible film for electrical insulation, and the second of which specifically describes polyimide film for general use in the industrial arts. As such, Ameen et al does not specifically disclose that its KAPTON is a thermoplastic polyimide.

The present Office Action does not comment on the comparative data presented in the declaration under 35 C.F.R. 1.132. The results of that declaration show that adhesion strength was extremely improved due to the existence of a thermoplastic polyimide compared with a non-thermoplastic polyimide.

The peeling strength set forth in the Examples of the present application, lying roughly between 4 and 6 N/cm, exhibits larger values compared with 1 to 2 N/cm of the comparative examples or those in the supplementary experiment.

When the peeling strength falls below 2 N/cm, the production of printed circuit boards is substantially impossible because the circuit tends to break off during the patterning (etching) of copper circuits and subsequent finishing steps (coating of a solder resist, lamination of cover-lay films, and tin, nickel or gold plating of terminals, etc.) required for the production of printed circuit boards.

In particular, when the peeling strength does not exceed 1 N/cm, the bending stress of the copper foil under measurement is larger than the adhesive strength whereby the copper foil is only lying on the substrate rather than being bonded thereto. In contrast, a peeling strength not lower than 4 N/cm can impart a resistance sufficient to withstand those steps, thus improving the efficiency of printed circuit board production. These facts indicate

that the invention of the present application is effective and helpful for the production of printed circuit boards.

Applicants prepared further experimental data (attached hereto) in order to compare the present intention with Ameen (US 5,681,443). In the previous declaration, it was described that adhesion strength was not excellent even though sputtering was conducted onto a non-thermoplastic polyimide film. That is, applicants indicated that there was no improvement in adhesion strength even though heating treatment was conducted into a film wherein a copper film was formed on a non-thermoplastic film (by sputtering).

Ameen et al. discloses a laminate wherein a conductor layer is formed directly on a substrate by a sputtering method or an evaporation method. Ameen teaches KAPTON as a substrate. However, Ameen does not disclose a thermoplastic polyimide.

However, the present invention indicates a laminate wherein a conductor layer is formed directly on the thermoplastic polyimide surface, and the laminate is heated so that a polyimide and a conductor layer are directly thermally fused. Accordingly, in the present invention, the adhesion strength between the thermoplastic polyimide and the conductor layer is enhanced.

Therefore, Applicants compared the adhesion strength of the laminate in the present invention with that of the laminate which does not include the thermoplastic polyimide wherein heating treatment (and pressurizing) was conducted.

Claims 1-11, 13, 17 and 18 were rejected under 35 U.S.C. §102(b) as being clearly JP62-60640. Favorable reconsideration of this rejection is earnestly solicited.

The abstract of JP '640 appears to disclose a laminated sheet comprising thermoplastic polyimide and a metal sheet or foil. The abstract further teaches that the lamination is carried out by hot pressing the laminated sheets or by extruding the resin together with the metal wire or by sputtering or vacuum depositing metal or chemical plating on the resin sheet.

In JP '640, there is a statement of "without using any adhesive, an adhesion strength is imparted". The methods of preparing a metal layer to which no adhesive is applied are the following two:

(1) Laminate a copper foil by heat (under application of heat and pressure onto the thermoplastic polyimide specified by JP '640).

(2) Without laminating a metal foil, conduct chemical plating, electric plating, sputtering, etc., onto the thermoplastic polyimide specified by JP '640.

In the second method, as an alternative for metal lamination, plating and the like are described as exemplary methods. In other words, JP '640 only describes various methods of directly forming a metal layer via plating or sputtering in parallel to the method of laminating a copper foil as the conventional and publicly known method for metal layer formation.

In the case of laminating a copper foil, heat is applied for the purpose of bonding the individual sheet-formed materials, as is common to Chen (US 5,156,710) and Ameen (US 5,681,443). In contrast, it is common practice to apply neither heat nor pressure when a metal layer is directly provided by, for example, plating as is shown in the embodiments of the cited reference.

The present application, which intentionally applies heat and/or pressure in such method, is not obvious in view of the cited references. Moreover, the material to be sputtered in the cited reference is a non-thermoplastic polyimide film and not a thermoplastic polyimide film.

Attached hereto are schematic illustrations of two heat lamination methods and a sputtering method. It is believed that these illustrations should clarify the differences between the present invention and the cited art.

As noted above, it is a common practice to apply neither heat nor pressure when a metal layer is directly provided by, for example, plating, as shown in the embodiments of JP '640. Furthermore, the contents of JP '640 can be considered to correspond to the comparative examples of the present specification.

For at least the foregoing reasons, the claimed invention distinguishes over the cited art and defines patentable subject matter. Favorable reconsideration is earnestly solicited.

Should the Examiner deem that any further action by applicants would be desirable to place the application in better condition for allowance, the Examiner is encouraged to telephone applicants' attorney.

In the event that this paper is not timely filed, Applicants respectfully petition for an appropriate extension of time. Please charge any fees for such an extension of time and any other fees which may be due with respect to this paper, to Deposit Account No. 01-2340.

Respectfully submitted,

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Enclosures: Declaration under 37 CFR §1.132
Schematic Illustrations (1 page)
TESS Records of KAPTON (2 pages)
Petition for Extension of Time